THURSDAY, MARCH 15, 1894.

TROPICAL BOTANIC GARDENS AND THEIR USES.

Der Botanische Garten "'s Lands Plantentuin" z v. Buitenzorg auf Java. Festschrift zur Feier seines 75 jährigen Bestchens. Mit 12 Lichtdruckbildern und 4 Plänen.

Eine Botanische Tropenreise, Indomalayische Vegetationsbilder und Reiseskizzen. Von Prof. Dr. Haberlandt. Mit 51 Abbildungen.

IF one casts a glance over the more modern botanical literature, it will become evident that special activity is being manifested in that department, which we may term, in accordance with the German usage, the biology of plants. The day has long passed since the eminence of a botanist depended on the number of plants —dried or otherwise—which he could recognise at sight. But it is not so long ago since exaggerated importance was attached to a minute and exhaustive knowledge of details of the internal structure of plants, although, fortunately, the practice did not last long enough, nor did it become sufficiently general, to render the mental burden so heavy as the load which the older systematists had to bear. It is clear, however, that in each instance the science passed, and indeed had inevitably to pass, through a similar phase. The facts must be accumulated before they can be grouped, or before sound general conclusions can be deduced from them. Of course, the processes of accumulation and deduction were not severed in point of time; but the success of the latter process depends largely upon the industry with which the first has been carried out. The practical results have culminated in the perception of the meaning of a "natural classification," on the one hand, and in the evolution of a morphology which embraces and welds together the dry facts of pure anatomy into a consistent system, on the other.

But the morphology of to-day differs widely from that of a quarter of a century ago, both in its breadth and, also, to some extent, in the way in which it deals with its materials. Thanks to the labours of men like Sachs, Schwendener, and others, we are attaining to a broader conception of the principles which underlie and which govern the structure of plants, and we recognise that the most minute details of the organisation may be traced, whether ultimately or immediately, back to the responsive action of the protoplasm to the exigencies of its environment.

And perhaps few causes have been more efficient in promoting this change of front from the older formal views, than the extended experience of the manifold adaptations exhibited by plants which has been gained as the result of observation and travel in regions where the conditions of vegetation differ widely from those which obtain in Europe. As one shock after another assails our crystallised notions of the "typical form," we are driven to admit that our carefully drawn up categories may break down, and become obliterated, or fused beyond all recognition. The one fact which does stand out clearly through all, is the immense capacity for adaptive modification exhibited, not only by vegetation as a whole, but by individual organisms in particular.

If we find the plant more plastic in structure than we had supposed, the fault lies, not with nature, but in the too rigid formality of our ideas respecting what we had conceived to be typical forms of segmentation, and upon our too scanty recognition of the truth that bodily segmentation is after all only an expression of organisation. And as this principle becomes more clearly apprehended, the purely abstract and merely descriptive anatomy grows increasingly obsolete, and gives way to a more intelligent method of dealing with the subject. But if it is now possible for the best workers to seek out the meaning and the bearing of the new facts they discover, the merit of the older observers should not therefore be lost sight of. They laboured, and we have entered into their labours and are reaping the harvest which was not ripe for them to reap, which could not have even been sown, had their patience not been what it was. We can recognise, what they only saw dimly, that convergent and parallel lines of development have played an important part in the evolution of plants; that identical, or closely similar structural, form may be reached from independent and often widely different starting-points. Moreover, we see in this ultimate form, not the realisation of an ideal Type (which is really an outgrowth of nominalism), but the very practical expression of the fact that these evolutionary lines are those which best enable the organism, with its special inherent and inherited disposition, to cope most successfully with the complex difficulties of its environment, and to solve most successfully the problem of its existence. And these conclusions have been arrived at as the result of careful study, not merely of dried specimens and of pickled material, but also by the observation of living plants under their natural conditions of growth.

There can be no question that it is in the tropics that this last, and by no means least, important branch of a botanical education can be most suitably carried out. Nowhere else are the facts, which a study of the living organism will teach, more forcibly impressed on the mind than in those regions where the infinitely more complex conditions of existence demand a correspondingly greater variety of adaptation than is the case in our colder latitudes.

And with the establishment of gardens and laboratories in the tropics, it becomes increasingly easy for every botanist to avail himself of the immense advantages of a study of the vegetation of these parts of the world, not under the artificial conditions of stoves and hot-house culture, but under the widely different aspect of fierce mutual competition, in which they maintain their existence in a state of nature.

The publication of the interesting account of the justly famous garden and botanical station in Java, on the occasion of its seventy-fifth anniversary, comes at a peculiarly favourable juncture; and it is to be hoped that a perusal of its pages will do much to stimulate many botanists, who as yet lack a personal acquaintance

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with tropical plant life, to go out and make use of the advantages now so easily within their reach.

The volume is a most interesting one; it tells of the difficulties which the enterprise of maintaining the "'s Lands Plantentuin" had to encounter and to overcome. Founded in 1817, it has succeeded in asserting its value, not only to the colony but also to science, and its importance in the latter respect is testified to by the number of botanists and others who annually visit it, as well as by the large amount of good work begun or carried out in its laboratories.

The volume, besides containing a description, illustrated with plans and photographs, of the garden and establishment at Buitenzorg, includes also an account of the various experimental stations which have arisen as offshoots from it. It contains, further, a useful *résumé* of the numerous investigations which have been conducted in connection with the gardens, and which have been published in various journals and reports. There is interesting and valuable information given concerning the culture and uses of economic plants.

But the gardens in Java, like our own colonial establishments of a similar nature, do not exist solely for scientific or ornamental purposes. Their use to the colony, and their importance in serving as a means for introducing and experimenting on the cultivation of vegetable products suitable to the country, cannot be overrated. The present writer recollects a well-known Ceylon planter observing, *à propos* of the garden at Peradeniya (in Ceylon), that it would have abundantly justified both its existence and its expense had it done nothing but serve as the means of introducing the cultivation of Cinchona into the island, during the interregnum which prevailed between the collapse of the coffee industry and the rise of tea. And this remark was the more striking, as it was made some years after experience had been shown that the growth of Cinchona could not be profitably pursued any further. The plant had, however, served its turn, and had saved the country from possible bankruptcy.

Amongst the list of visitors to the Java garden, one notices the name of Prof. Haberlandt, and he has given us his impressions of the tropics in a most delightful volume. It is true that there is not, perhaps, much that is actually new to any one who is versed in modern botanical literature, but Dr. Haberlandt tells what he has to say in a charmingly enthusiastic and artistic manner; and his pages are illustrated with impressionist sketches which convey an excellent idea of the character of the objects portrayed.

The book is what it professes to be—an account of a "botanical excursion"; but besides the chapters on epiphytes, mangroves, hill and desert floras, there are sections devoted to observations on the natives and their ways, as well as others on the climate and meteorology of Java. The chief value of the volume lies in the perception of things which will, or should, attract the eye of a traveller new to the tropics; and while the work may be praised as one full of matter of considerable general interest, it may be especially commended to those who are themselves about to undertake a journey to the East.

J. B. F.

THE TELEPHONE.

A Manual of Telephony. (The Specialists' Series.) By W. H. Preece, C.B., F.R.S., and Arthur J. Stubbs. (London: Whittaker and Co., 1893.)

ONLY about four years ago we reviewed a treatise entitled "The Telephone," by Mr. W. H. Preece and Dr. Maier, which up till recently was the chief manual on its special subject in English. The rapid advance of telephony, however, had rendered large portions of that work completely out of date, and Mr. Preece, with, this time, Mr. A. J. Stubbs as co-worker, has completely rediscussed the subject, and replaced the former treatise by the present.

The work is divided into six parts, and each of these again into some half-dozen chapters. Part i. deals with the construction and mode of action of telephones and transmitters, ii. with general apparatus and switches, iii. with simple exchange stations, iv. and v. with the more complicated and extensive exchanges, their switchboards, &c., and vi. with the construction of telephone lines and cables.

What we said about the merits of the former book we have here to repeat. Nowhere else in English have we so full and accurate descriptions of telephones and transmitters, or so practical and detailed accounts of telephonic apparatus, and the mode of carrying on the work of telephone exchanges. This, by far the greater part of the book, is extremely well done, and we have no doubt that as a practical guide and help to the telephonic engineer, it will be of very great value.

Anything we have to say in the way of criticism on the contents of the book resolves itself in the main into a few remarks on the first chapter and the last, in both of which we find sections that seem to require slight improvements.

In chapter i. we have a very brief account of current induction. This is clear in general, but one or two statements ought to be amplified in order to prevent misunderstanding. On p. 9 it is affirmed that the intensity of the magnetic force in the field of a conductor carrying a current varies inversely as the square of the distance from the conductor. This statement cannot be said to be true except of a short current element, in which case the magnitude of the force is as stated, and its direction at right angles to the plane determined by the element and the line joining it to the point at which the force is being considered.

The conductor contemplated in the next sentence seems to be a straight one of unlimited length, for in other cases the lines of magnetic force are not *circles* round the wire, unless, of course, the wire be very thin, and the field at points only which are very close to the wire be considered. In the case of a single long straight conductor the magnetic force varies inversely as the distance from the conductor.

Again, it is stated in p. 11, that "there are two classes of induction": that is, induction of currents produced by the variation in position or magnitude of currents in neighbouring conductors, and induction due to changes in the magnetic field in which the conductor acted upon is situated. Of course the authors do not mean to assert

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